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Monterey, California, Naval Postgraduate School

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# NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

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## MBA PROFESSIONAL REPORT

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### Acquiring Combat Capability through Innovative Uses of Public Private Partnerships

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By: **Steven M. Buchanan,  
Jayson W. Cabell, and  
Daniel C. McCrary**  
**June 2006**

Advisors: **Joseph G. San Miguel  
John K. Shank  
Don E. Summers**

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<p>The purpose of this research is to study the federal government's historical use of public-private partnerships (PPPs) and their view on the issue. Then we study recent applications (case studies) of innovative financing arrangements by Hannon Armstrong, LLC, an Annapolis, Maryland based financial services firm. The intention is to build upon previous Naval Postgraduate School research efforts in this subject; specifically, expanding upon the efforts of Professor San Miguel, Shank and Summers by investigating current examples of PPPs. First, we examine Hannon Armstrong's "fee for service contract" solution to the lack of appropriated capital funds needed for a vital fiber-optic link near the Arctic Circle. Then, we will explore the history of the Energy Saving Performance Contracts (ESPCs), which have been a useful tool in reducing the energy consumption throughout the federal government. Historically, this program has only been used for fixed assets. There is little debate over the success of these contracts in reducing energy consumption. The authors believe that applying Energy Savings Performance Contracts to mobile assets could further reduce the energy consumption of the Department of Defense (DoD) and save tax-payers millions of dollars.</p>			
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**ACQUIRING COMBAT CAPABILITY THROUGH INNOVATIVE  
USES OF PUBLIC PRIVATE PARTNERSHIPS**

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Submitted in partial fulfillment of the requirements for the degree of

**MASTER OF BUSINESS ADMINISTRATION**

from the

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# **ACQUIRING COMBAT CAPABILITY THROUGH INNOVATIVE USES OF PUBLIC-PRIVATE PARTNERSHIPS**

## **ABSTRACT**

This research examined the federal government's historical use of public-private partnerships (PPPs) to determine whether or not Energy Savings Performance Contracts (ESPC) should be applied to mobile assets. Third party financing of capital improvements through PPPs has resulted in reduced energy consumption and savings to tax-payers. For example, to modernize existing facilities, the government has used private corporations, such as Hannon-Armstrong, LLC, to overcome shortfalls in appropriated funds. Third party financing and ESPCs present viable solutions to modernizing and reducing the energy consumption of the government's mobile assets.

The first part of this research examines Hannon Armstrong's "fee for service contract" solution to funding the vital fiber-optic link near the Arctic Circle. The second part explores the history of the Energy Saving Performance Contracts (ESPCs), which have helped reduce energy consumption throughout the federal government. Historically, this program has only been used for fixed assets. There is little debate over the success of these contracts in reducing energy consumption. The authors conclude that applying Energy Savings Performance Contracts to mobile assets could further reduce the energy consumption of the Department of Defense (DoD) and save tax-payers millions of dollars.

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## IN MEMORY

**John K. Shank, Ph.D.:** Dr. Shank was a support advisor on this project; his contribution and inspiration were vital to its success. Sadly, towards the end of this project, on March 30, 2006, John died of heart failure at the age of 65. John instructed all the students who authored this document during their MBA studies at the Naval Postgraduate School; his untimely death touched us all.

John was the Noble Foundation Professor of Management emeritus at the Tuck School at Dartmouth and a visiting professor at the Naval Postgraduate School. Outside the United States, he taught MBA programs in Amsterdam, Barcelona, Ghent, Helsinki, Lausanne, London, Paris, Prague and Stockholm. He published 17 books, more than 100 case studies and 100 articles in leading journals in accounting, finance and management; his most recent research interests centered on the strategic cost management theme, which he pioneered.

Professor Shank earned an AB degree from Oberlin College, an MBA from the University of Pittsburgh, and a doctorate in accounting from Ohio State University. He was a member of Phi Beta Kappa, Beta Gamma Sigma, Beta Alpha Psi and the American Accounting Association and a former member of the American Institute of Certified Public Accountants, the Institute for Management Accountants, and the Financial Executives Institute. Before joining the Dartmouth faculty, he taught at Ohio State University for eight years and the Harvard Business School for seven years. Prior to that, he worked in public accounting for both of the firms that merged to form Deloitte & Touche. He also worked in private industry as controller of a small frozen foods manufacturing firm.

Professor Shank was active in the Management Accounting Section of the American Accounting Association. He was the founding chairman of the Management Accounting Executive Committee of the AICPA and the founding chairman of the steering committee for the AICPA's Center for Excellence in Financial Management. He was a founding member of the AICPA's "Group of 100" advisory board, and was editor-in-chief of the Handbook of Cost Management. He recently served on the editorial

boards of Cost Management and Advances in Management Accounting. He was a member of the Board of Directors at Lazard, Ltd.

Professor Shank was also involved in consulting projects and management education seminars with more than 100 major companies over a 40-year period, including General Electric, IBM, AT&T, Chase Bank, American Express, Digital Equipment, Coca-Cola, Eastman Kodak, Johnson and Johnson, Citicorp, Allied-Signal, Cargill, Brooks Brothers, Lucent Technologies, Fortune Brands, International Paper, Alcan Aluminum and Hewlett Packard. He also worked as a consultant to the World Bank, the French Ministry of Post Telephone and Telegraph, and the National Association of Independent Schools. Recent assignments included projects with Giant Eagle Supermarkets, HJ Heinz, and the U.S. Navy (Office of the Chief of Naval Operations).

## ACKNOWLEDGMENTS

**Hannon Armstrong, LLC:** The cases developed in our research were focused on acquiring combat capability through innovative uses of public-private partnerships. We studied currently relevant innovative financing solutions of Hannon Armstrong, an Annapolis, MD based financial services firm that specializes in the federal market. Their assistance has been a tremendous asset to us as we have compiled this research data. A special thanks to Jeffrey Eckel, President and CEO of Hannon Armstrong and Gerald Koenig, Vice President responsible for homeland security and defense programs.

**Nayantara Hensel, Ph.D.:** Dr. Hensel contributed guidance to this project. Nayantara Hensel is an assistant professor of finance and economics at the Graduate School of Business and Public Policy at the Naval Postgraduate School. She received her B.A., M.A. and Ph.D. from Harvard University.

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## **I. INTRODUCTION**

### **A. INTENDED PURPOSE**

The purpose of this research is to study federal government's historical use of public-private partnerships and different views on the issue. Through case studies, we will examine innovative uses of public-private partnerships to overcome shortfalls in appropriated funds. We will determine whether applying Energy Savings Performance Contracts (ESPCs) to mobile assets is a viable solution to reducing energy consumption, overcoming funding constraints, and reducing energy costs, which will save tax-payer dollars. The Department of Defense is the largest consumer of energy within the federal government. About 60 percent of the DoD's energy consumption is used to operate aircraft, tanks, ships, and other vehicles.<sup>1</sup> Utilizing ESPCs, which are based on public-private partnerships, could help reduce the DoD's fuel burden, enhance warfighting capabilities, and extend the service life of mobile assets. In order to understand how an EPSC is structured it is important to first understand the role of public-private partnerships (PPPs).

### **B. HISTORY OF PUBLIC-PRIVATE PARTNERSHIPS (PPPs)**

PPPs establish a cooperative partnership between the public and private sectors in order to pool resources towards a common goal. PPPs allow a public agency to access the private sector's technical expertise, knowledge, insight, and capital to achieve mutually beneficial goals. These partnerships can be used by agencies at the federal, state and local levels. Contracts for PPPs are developed in such a way that control in an activity is given to the entity, either public or private, that is in the best position to control and achieve the desired results. PPP contracts are structured so that they provide incentives to the controlling entity to achieve efficiencies and reduce costs in performing activities. In order to meet these performance goals, the controlling entity is given maximum flexibility to develop its work structure and processes to achieve its directives.

---

<sup>1</sup> Data compiled from Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms, More Capable Warfighting Through Reduced Fuel Burden, January 2001 pg. 3.

The federal government has increasingly relied on public-private partnerships for the accomplishment of a number of agency activities. In the broadest sense, the federal government is a big box with inputs and outputs. All federal outputs are services; whether it is air traffic control, delivered mail or the Normandy invasion. The federal government manufactures virtually nothing. Now, if the federal government produces services, their inputs can be pure services or (as is usually the case) a combination of goods and services. These inputs all predominantly come from the private sector. So the question is what mix of private sector goods (inputs) and private sector services (inputs) is optimal from an efficiency viewpoint.

PPPs are used throughout the federal government in areas such as: technology and pharmaceutical research, depot level maintenance, transportation projects, military housing and renovation, supply of utilities, and education programs. These partnerships help the government agencies accomplish projects or activities in a faster and more efficient manner.

Legislation and federal acquisition regulations that have impeded the use of public-private partnerships have slowly been changed to allow the federal government to more easily enter into partnerships and making it more lucrative for private firms.<sup>2</sup> Figure 1 illustrates legislation that has affected PPPs from 1955 to 2000.<sup>3</sup>

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<sup>2</sup> RAND Corporation. (1998). Use of Public-Private Partnerships to Meet Future Army Needs. Ch 3, p. 21.

<sup>3</sup> Ibid, p. 20.

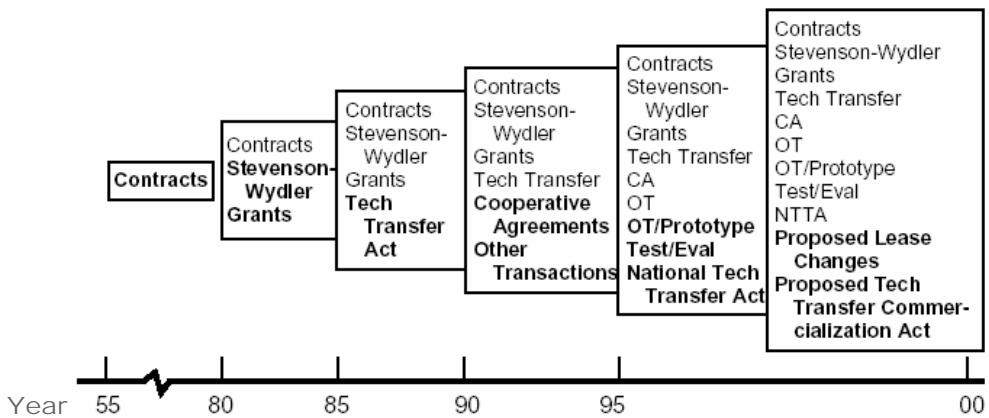


Figure 1: Timeline of Major Legislative Actions Affecting PPPs<sup>4</sup>

Over the past twenty years legislative actions have introduced Cooperative Research and Development Agreements (CRADAs), Cooperative Agreements (CAs), and Other Transactions (OTs) that have enabled the military to more effectively partner with private entities.<sup>4</sup> Figure 1 shows the major legislative changes that have occurred from 1955 until 2000. Many of these changes have reduced barriers that prevented the public and private sectors to work together. As legislative barriers are reduced, the federal government is able to establish more partnerships and use innovative and creative solutions to overcome resource constraints. In conducting its research, the RAND Corporation noted that the U.S. Army has realized the following benefits by utilizing PPPs:<sup>5</sup>

- leverage its assets, reduce capital investments, reduce costs
- decrease outlays to achieve infrastructure, intellectual property, or financial arrangement goals
- increase the value of its property or other assets
- create new capabilities or assets to accomplish its military mission

<sup>4</sup> RAND Corporation. (1998). Use of Public-Private Partnerships to Meet Future Army Needs. Ch. 3, p. 20.

<sup>5</sup> Ibid, Ch. 1, p. 2-3.

- influence technology early and get equipment fielded earlier and/or possibly at lower cost
- improve readiness
- receive a stream of revenue to fund projects to help the Army accomplish its mission

There are many different types of Public Private Partnerships. This research focuses on two major types, “fee for service” and ESPCs. One of the major differences between traditional procurement, a “fee for service” contract, and an ESPC is not what goods and services are being bought by the federal government, but how the contractor gets paid. Under a traditional procurement model, a contractor gets paid when the goods are delivered. Federal employees traditionally perform the bulk of the labor required to convert the goods into a service.

Under an ESPC, the contractor installs energy savings equipment and gets paid when and if the installed equipment produces savings. Contractors under a “fee for service” contract get paid once they have performed the work that they were contracted to perform, i.e., mow the lawn, deliver the ammo to Baghdad, or provide some other type of service to the government.

Another major difference between traditional funding approaches, “fee for service,” and ESPCs is who bears the costs that result if the service is performed badly: the taxpayer or the contractor? In “fee for service” and ESPCs the contractor assumes most of the risk. In traditional funding approaches, the taxpayer assumes the risk and there is little accountability (what recourse does the taxpayer have if the service provider at Tinker AFB takes 25 more days than required to overhaul a TF-33 engine?). Under a “fee for service” or ESPC type contract, the contractor is held accountable for performance by withholding payment for services that do not meet predetermined performance criteria. The assumption of risk is one of the major advantages of using PPP to perform certain functions within the federal government.

## II. CASE STUDY ONE

### A. INNOVATIVE USE OF FEE FOR SERVICE CONTRACT

This section presents an innovative financing arrangement by Hannon Armstrong, an Annapolis, Maryland based financial services firm that specializes in federal contract financing. We will examine Hannon Armstrong's "fee for service contract" financing solution for providing a vital fiber-optic link near the Arctic Circle. Under a fee for service contract, title for the assets does not transfer to the federal government. The familiar defense acquisition management acronym, Contractor-Owned and Contractor-Operated (COCO) applies to the assets which are used by the government in this scenario.

#### 1. Introduction to the Arctic Circle Fiber-Optic Scenario

The United States (U.S.) government collects critical environmental and weather information on Svalbard Island, Norway, a unique location on an island above the Arctic Circle. Information gathered at Svalbard was sent via an Intelsat satellite to the U.S. This communication method was expensive, slow, and unreliable.

The Norwegian Space Agency and Tyco Telecommunications, along with the National Oceanic and Atmospheric Administration (NOAA), the United States Air Force (USAF), and the National Aeronautics and Space Administration (NASA) jointly developed a technical solution to the problem. This consisted of installation of a dual 1300km fiber-optic cable-ring communications network at the Svalbard Satellite Tracking Station (SvalSat), which is located on Plateau Berget, Spitzbergen Island, Svalbard.

However, despite the project's huge future savings to the U.S. government, appropriated funds were not available for the required \$40 million initial capital investment. The answer was a service contract from the Norwegian Space Agency and an innovative third party financing arrangement using Hannon Armstrong to finance the \$40 million capital expenditure.

Svalbard's position at 78 degrees North Latitude allows contact with polar-orbiting satellites during all 14 daily orbits, making SvalSat an ideal location for tracking these satellites that stations in lower latitudes can not match. The installation of the communications cable is a vital component of the satellite facility SvalSat's infrastructure and a primary driver for NASA's and NOAA's participation with the Norwegian Space Center (NSC) at SvalSat.

The Project is geographically depicted on the following map, Figure 2.



Figure 2: Fiber Optic Scenario Project Map of Cable

## 2. Background of the Arctic Circle Fiber-Optic Project

NOAA, NASA, and the DoD collect data from satellites in polar orbits that provide weather and environmental information covering all areas in the world. This data supports such critical and diverse uses as: regional weather forecasting, aviation forecasts (domestic, military and international), severe storm and flood reconnaissance and warnings, solar and space environmental forecasts, hydrologic forecasts, seasonal and long term weather monitoring and forecasting, environmental air quality monitoring, and defense tactical decision information and weapon systems utilization.

Polar-orbiting satellites orbit the earth from pole to pole. As the Earth rotates, each pass covers a different swath of the terrain below. Typically, these satellites orbit 600 miles above the Earth and carry a wide variety of sensors that provide data for numerous applications. These are in considerable contrast to the typical communications satellites in geo-stationary orbits that are approximately 22,000 miles above the Earth's surface and orbit at a speed synchronized with the Earth's rotation, thereby staying over one place on the Equator. The polar-orbiting satellites represent the principal means of collecting data over vast areas of the globe. The data for aviation weather, global shipping, disaster prediction, etc., are of vital interest to the U.S. Government.

U.S. weather, oceanographic, and environmental data have historically been collected by a variety of separate systems and agencies: by NASA for scientific and environmental use, by NOAA for civilian use, and by DoD for military use. In 1994, the U.S. Congress created the National Polar-orbiting Operational Environmental Satellite System (NPOESS) as the next generation system to monitor global environmental conditions and collect data related to weather, atmosphere, oceans, land and near-space environment.

In creating NPOESS, Congress recognized that combining the existing polar satellite systems from NASA, NOAA, and the DoD would result in a more cost effective, and better performing integrated system. The President endorsed this initiative, signing Presidential Decision Directive NSTC-2.<sup>6</sup> NPOESS is managed by the Integrated Program Office (IPO), which organizationally resides within the Department of Commerce (DoC). The IPO employs personnel from NOAA, DoD, NASA, and the DoC.<sup>7</sup> IPO is housed within, and is administratively part of, NOAA in Silver Spring, Maryland. In August 2002, Northrop Grumman and Raytheon were awarded a \$2.9

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<sup>6</sup> Presidential Decision Directive/NSTC-2; accessed March 08, 2006;  
<http://www.ipo.noaa.gov/About/NSTC-2.html>

<sup>7</sup> NOAA Satellite and Information Services website; Integrated Program Office (IPO); accessed Mar 08, 2006; [http://www.ipo.noaa.gov/About/ipo\\_org.html](http://www.ipo.noaa.gov/About/ipo_org.html)

billion contract to build and support the first two NPOESS through 2012, with options for an additional four satellites through 2019 for a total of \$4.5 billion.<sup>8</sup>

The chart in Figure 3 illustrates how NPOESS is currently organized.

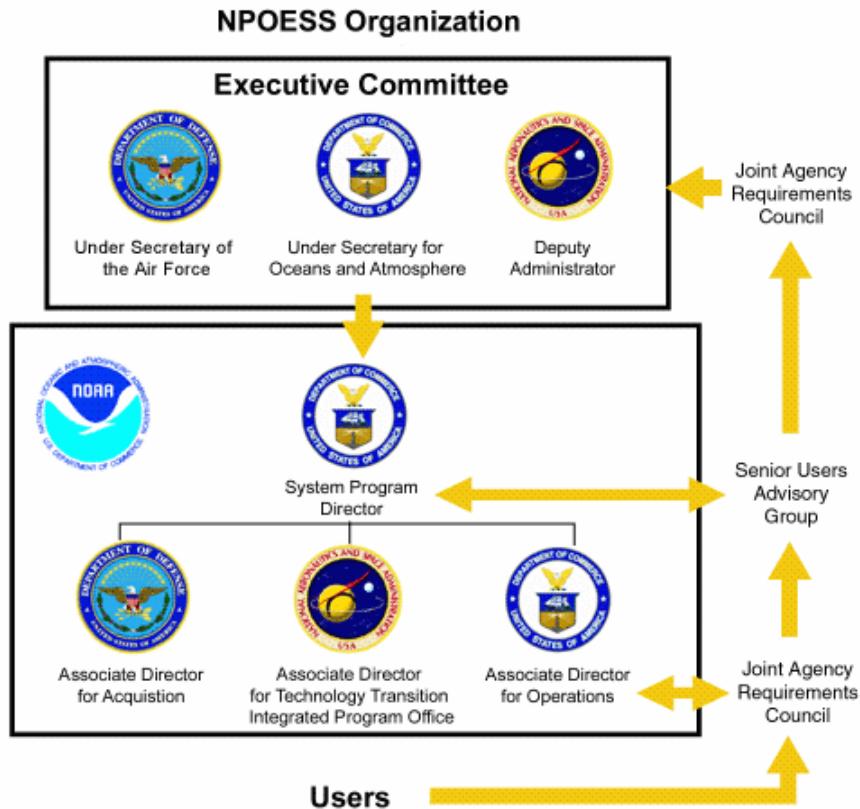


Figure 3: NPOESS Organization  
 From NOAA Satellite and Information Service website;  
[http://www.ipo.noaa.gov/About/ipo\\_org.html](http://www.ipo.noaa.gov/About/ipo_org.html); accessed Mar 10, 2006

### 3. The Economic Aspect of the Arctic Circle Fiber-Optic Project

The existing NOAA and DoD satellites that will ultimately be replaced or augmented by NPOESS will increase their use of the SvalSat facility over the next decade. As additional sensors and capabilities are added there will be a greater need for both command and control and data transmission. NOAA and the DoD missions require

<sup>8</sup> The original NPOESS contract was awarded in 2002 to TRW, Inc. Later the same year, TRW was acquired by Northrop Grumman, so Northrop Grumman became the prime contractor for NPOESS. Raytheon was formally teamed with TRW at the time of contract award and thus automatically became a subcontractor upon award of the prime contract to TRW and that subcontractor status was unaffected by Northrop Grumman becoming the prime contractor.

an enduring capability to acquire, store, and disseminate to processing centers, global and regional meteorological, environmental, and associated data at varying refresh rates. These data shall include, but are not limited to information on imagery, atmospheric profiles of temperature and moisture, and other specialized meteorological, terrestrial, climatic, oceanographic, and solar-geophysical data, as well as a search and rescue capability to support world-wide U.S. Government (Military and Civil) operations and high-priority programs.

With the additional requirements of the NPP and NPOESS programs, combined NOAA/NASA telecommunications costs using existing leased satellite capacity for telecommunications transmission would have been approximately \$10 million per year. The installation of a dual fiber-optic ring communications network to SvalSat would offer expected combined savings of \$2.5 million per year over the repayment period, and nearly the full \$10 million to be saved annually by the U.S. Government over the remainder of the 25-year initial period of operations.

#### **4. Innovative Financing Solution of the Arctic Circle Fiber-Optic Project**

The contractor that was chosen to install the fiber-optic network, Tyco Telecommunications (US), Inc. (Tyco Telecom), Princeton, N.J., declined to accept deferred annual payments from the U.S. agencies, said Rolf Skår, Director General of the agency.

“To get Svalbard into the picture, we had to do something,” Skår said. “The challenge was how to finance the project...none of the suppliers was willing to accept deferred payments.”<sup>9</sup>

Tyco Telecom, a world leader in the installation and servicing of state-of-the-art submarine fiber optic cable systems, won an international tender issued by NSC to supply and install the project. This consisted of a dual fiber optic cable ring, with each segment connecting the SvalSat station in Longyearbyen, Svalbard to the Telenor (the main Norwegian telecom utility) system in Halstad on the Northern Cape of Norway, the nearest part of the European mainland. Tyco will be providing terminals and other

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<sup>9</sup> Defense News; Finding Savings Up Front-Private Investors Finance Fiber-Optic Link Near Arctic Circle; Gopal Ratnam; Nov. 17, 2003; Vol. 18, No. 43.

related equipment to complete the project as part of its scope. Each segment of the ring will run approximately 1400 km (see Figure 2). The dual cable ring system provides necessary redundancy in the unlikely event one cable requires repair. Capacity of the project will be 20 GB per second over each of the two segments of the line.

The economic solution that was ultimately chosen was to convert planned operating dollar expenditures into a stream of payments that could support the capital investment required in the “fee for service” or “paid from savings” contract, as depicted in Figure 4. By converting annual operating payments for rented communications satellite capacity into service contract payments for a next generation data communication system, the U.S. government was able to save \$140 million over the 20-year contract term, while it improved the system capacity and reliability. Hannon Armstrong structured and funded the transaction.<sup>10</sup>

Example:

	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>...</u>	<u>2025</u>	
<b>Scheduled Pmts to Intelsat:</b>	\$6m	\$10m		\$10m	...	\$10m
<b>Total Payments:</b>			\$200m			
<b>System Cost:</b>			\$40m			
<b>Net Savings:</b>						<b>Approximately \$140m</b>

Figure 4: The Economic Solution to Case Study  
 From Hannon Armstrong website;  
<http://www.hannonarmstrong.com/files/CMANorwaycs.ppt.ppt#261,5,Slide 5>

The transaction is structured as Hannon Armstrong’s purchase of NASA and NOAA receivables from NSC. These receivables arise pursuant to the Intergovernmental Agreement. Later, NOAA and NASA will make their Contract Payments to the Hannon

10 U.S. General Services Administration-Office of Citizen Services and Communications Newsletter-Innovative Funding; Government Agencies: Meeting the Challenge Using Innovative Funding Strategies; Dan McMahon & Hannon Armstrong; Issue 15; Oct 2004; pg 16; available <http://www.gsa.gov/intergov>

Armstrong Space Centre Funding account according to the Assignment Agreement and the Lender, who provided the initial capital, will receive its debt service payments from this account.

The diagram in Figure 5 depicts the flow of funds in the financing solution that was explained above.

## The Financing Solution

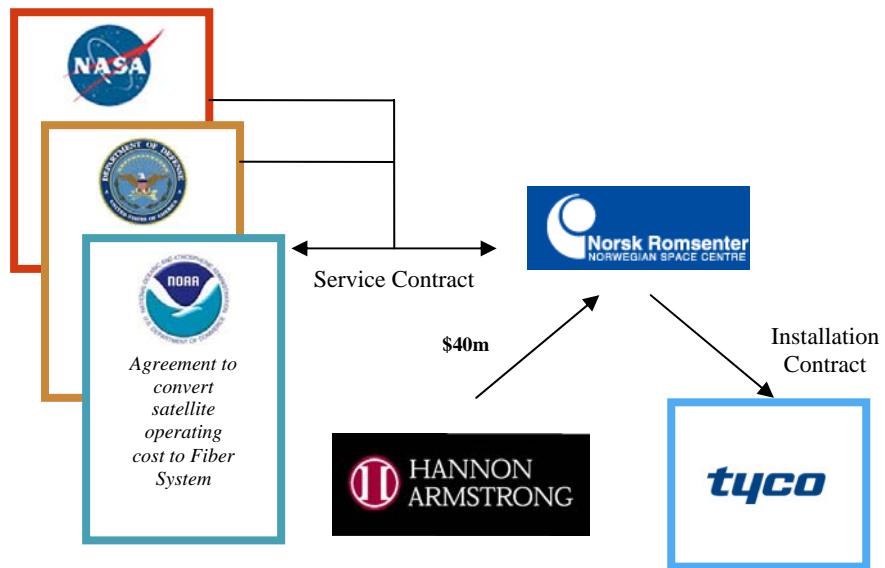


Figure 5: The Financing Solution to Case Study

From Hannon Armstrong website;

<http://www.hannonarmstrong.com/files/CMANorwaycs.ppt.ppt#262,6,Slide 6>

Hannon Armstrong raised the money for the up-front capital required for the project through private placement among its investors. Unlike public issue of stocks and bonds where the law mandates extensive dissemination of information about the project to the public, private placement usually involves raising money from sophisticated financial institutions, such as major banks, pension funds, and large insurance companies.<sup>11</sup> Unlike other sectors of the capital markets, investing in federal contract financing requires a refined understanding of how federal operations differ from

<sup>11</sup> Defense News; Finding Savings Up Front-Private Investors Finance Fiber-Optic Link Near Arctic Circle; Gopal Ratnam; Nov. 17, 2003; Vol. 18, No. 43.

commercial operations. Moreover, once these sophisticated institutional investors understand the real, as opposed to perceived, risks of federal contracts, they accept a lower return commensurate with the lower risk. Thus, the cost of capital is lower, as is ultimately the price for the service provided. The \$40 million raised by Hannon Armstrong for this fiber-optic system remained in an escrow account and was paid to Tyco when it met milestones determined by the Norwegian agency. Hannon Armstrong's return on investment is not realized until the payments are made over a period of years by NASA and the IPO, which includes NOAA, the DoD, and the DoC. Total repayments will total about \$50 million over five years.

The cable will cost each agency \$5 million a year for five years. Under an agreement with the Norwegian Space Center, the agencies will then have almost free use of it until 2030. The agencies will save about \$1 million a year over the cost of using the relay satellite for five years, and then each will save the whole \$6 million a year for 15 more years, according to Bill Watson, program executive in NASA's Office of Earth Science.<sup>12</sup> For a total of \$50 million, \$190 million in future costs will be avoided saving around \$140 million for NASA and the OIP. This is supported in the following statement:

The financing illustrates how the government can utilize private capital to save the public sector a lot of money while upgrading its service. NASA and NOAA will each realize an immediate \$1 million per year cost savings by switching service to the fiber optic cable, instead of commercial satellite data transmission. After the initial 5-year period, the agencies will no longer owe service payments and will each be able to realize full savings for the next 22 years...the advantages for the U.S. government were clear as agencies are able to access a critical service without seeking new Congressional appropriations.<sup>13</sup>

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12 Federal Computer Week; Listening to the Arctic Skies-NASA, NOAA use Norwegian Facility to gather weather and climate data from satellites; Michael Hardy; Jan 06, 2004.

13 U.S. General Services Administration-Office of Citizen Services and Communications Newsletter-Innovative Funding; Government Agencies: Meeting the Challenge Using Innovative Funding Strategies; Dan McMahon & Hannon Armstrong; Issue 15; Oct 2004; pg 16; available <http://www.gsa.gov/intergov>

## **5. Operational Aspect of the Arctic Circle Fiber-Optic Project**

With the installation of a dual fiber ring communications network to SvalSat, transmission speed of the system improved significantly; the new system is twelve times faster than the old system.<sup>14</sup> In addition to a major increase in bandwidth, reliability improved significantly. The SvalSat tracking station provides the ideal location for maximum visibility (transmission window) to communicate with polar-orbiting satellites on each of their approximately 14 daily orbits around the earth. This visibility along with a robust communications network enables critical operational missions and the collection of extremely high-resolution data to achieve the best, most reliable performance possible to protect the health, safety, and welfare of the United States and its global partners.

Due to the very low angle to the horizon, the Intelsat satellite link experiences various transmission disruptions that occur due to bi-annual sun outages and other atmospheric effects that alter data reliability and timeliness. Although there are receiving stations in Fairbanks, Alaska and Wallops Island, Virginia, these stations have blind spots that prevent them from seeing the satellites and downloading their data on three of their fourteen daily orbits.<sup>15</sup> Finally, there is a material economic benefit since the cost of the current leased telecom satellite capacity is over \$6 million per year.

## **6. Risks Associated with the Arctic Circle Fiber-Optic Project**

NOAA and NASA each have the right to terminate for convenience their respective use of the telecommunications services pursuant to the Project Implementation Agreement (PIP)/ Memorandum of Understanding (MOU). In either case, a termination prior to an agency's final payment will cause the agency to pay to NSC the unpaid part of the payment schedule set forth in the PIP three months after the termination date. This

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<sup>14</sup> The rate of transmission over this telecom satellite was approximately 48 million bits per second. (Mbps) (as compared to the two 155 Mbps channels that NASA and NOAA will each be allotted for a total of 620 Mbps from the Project's cable capacity.

<sup>15</sup> U.S. General Services Administration-Office of Citizen Services and Communications Newsletter-Innovative Funding; Government Agencies: Meeting the Challenge Using Innovative Funding Strategies; Dan McMahon & Hannon Armstrong; Issue 15; Oct 2004; pg 16; available <http://www.gsa.gov/intergov>

termination amount will be sufficient to fully amortize the Hannon Armstrong investment and cover interest for the two intervening months between termination and payment of the termination amount.

Additionally, the contract has a non-appropriation clause. Specifically, Article 4 of the Intergovernmental Agreement states that “obligations under this Agreement and any implementing arrangements hereunder shall be subject to the availability of appropriated funds”. To fund this project, the U.S. government is using operating funds that are appropriated annually by the U.S. Congress. According to the Anti-Deficiency Act, the Executive Department cannot commit to a binding obligation in excess of its funding. This project represents a decrease in annual funding requirements compared to a commercial satellite lease, and offers significant long-term savings; therefore, it is assumed that funding will continue. Nevertheless, the availability of future appropriated fund is an import risk to consider.

## **7. Financial Analysis of the Fiber-Optic Cable Project**

The savings stated above were from publicly available sources and not created by the authors. In this section, an independent net financial analysis concerning the capital investment of the fiber-optic line is presented. Using the discounted present value technique, the time value of money (TVM) is taken into consideration. The time value of money is based on the premise that one will prefer to receive a certain amount of money today than the same amount in the future, all else being equal. The time value of money (TVM) or the discounted present value is one of the basic concepts of finance, developed by Leonardo Fibonacci in 1202.<sup>16</sup>

For this analysis, the cost of capital to the government was deemed to be the ten-year Treasury Bill rate. We used the like-term US Treasury instrument rate as the discount rate in accordance with OMB Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*. As of April 2006, the rate of a ten-year and thirty-year Treasury Bill was approximately 5 percent.<sup>17</sup>

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<sup>16</sup> Wikipedia, The Free Encyclopedia; available: [http://en.wikipedia.org/wiki/Time\\_value\\_of\\_money](http://en.wikipedia.org/wiki/Time_value_of_money).

<sup>17</sup> The Treasury Bill rates were used as the Government’s cost of capital; on Apr 09, 2006, the 10 year Treasury Bill rates was 4.98 percent and the 30 year T-bill rate was 5.05 percent. Therefore, 5 percent was used in the analysis. Rates accessed: <http://money.cnn.com/markets/bondcenter/>

The government ultimately chose to use Private-Public Partnership to fund the fiber-optic system. This analysis will examine the options available to the government at the time they chose between the alternatives. The life-cycle costs of the three options are analyzed over the twenty-year period of the contract: status quo, pay for the fiber-optic line outright or using the financing method described above. The weather and environmental information gathered at this particular location is critical. Since no alternative locations are available, not collecting environmental and weather information at this location was eliminated as an option.

**Option 1 – Status quo:** If the current location is used and the fiber-optic line is not installed, then the government will make payments of ~\$10 million a year for twenty years.<sup>18</sup> Since the fiber-optic line will not be installed under this option, zero saving will be realized. The total ~\$200 million payments equate to a present value of ~\$130.9 million when discounted at 5 percent. Therefore, the net cost of the status quo option is ~\$130.9 million over the 20 years.

**Option 2 – Pay for the fiber-optic line outright in one single lump-sum payment at the beginning of “year one” of the contract:** The one time expenditure (use of funds) of ~\$40 million would result in savings (sources) to the Government of ~\$130.9 million over 20 years<sup>19</sup>; the result of the up-front investment is a net life-cycle cost of ~\$40 million (\$40 million investment today eliminates payments for twenty-year period).<sup>20</sup> This option results in a net present value savings of \$90.9 million (\$130.9 million in savings minus the \$40 million investment). Note that savings will continue past twenty years since the project was undergone.

**Option 3 – Public-Private Partnership:** The present value of the payments (uses) under this option is ~\$45.5 million over the five-year payment period; the first five years of the contract require \$10 million a year in payments (\$5 million per agency). For the fifteen years after the payment period, the agencies will then have almost free use of the

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<sup>18</sup> With the additional requirements of the NPP and NPOESS programs, combined NOAA/NASA telecommunications costs using existing leased satellite capacity for telecommunications transmission would have been approximately \$10 million per year.

<sup>19</sup> \$10 million a year \* 20 years discounted at 5%, annuity due.

<sup>20</sup> almost free use of the fiber-optic line under an agreement with the Norwegian Space Center.

fiber-optic line under an agreement with the Norwegian Space Center. The present value of the savings realized during this period is ~\$109 million.<sup>21</sup> Since these savings will not be realized until after year five, the savings must be discounted back to period one, resulting in savings of ~\$85.4 million. Therefore, this option results in a net present value savings of ~\$39.9 million (\$85.4 million in savings minus the ~\$45.5 million investment discounted over five years) over the twenty-year period analyzed. Note: savings will continue past twenty years since the project was undergone.

The chart below summarizes the net savings from the financing alternatives that were compared above (millions).

Options	(Over Twenty year contract)			
	Upfront Uses	Outflow	Inflow	Life-cycle costs
1) Status quo		130.9		130.9
2) Purchase system	40		-130.9	-90.9
3) Private-Public Partnership		45.5	-85.4	-39.9

Figure 6: Net Savings Over Twenty Year Period (millions)<sup>22</sup>

From the analysis, the “cheapest” option for the government is to pay for the \$40 million initial capital investment upfront. The discounted savings realized by this option is ~\$90.9 million versus a savings of ~\$39.9 million using Private-Public financing. Both of the options trump the status quo, which results in the highest life-cycle cost. While numbers can help quantify each alternative, it does not take sophisticated financial analysis to come to the aforementioned conclusion. While, it always appears cheaper to purchase an asset upfront because there are zero finance charges, money from the treasury is not free nor is private sector capital. Since capital is not readily available and the Federal Government operates at a deficit, the funds must be borrowed to purchase an asset outright. Therefore, the cost of capital must be considered in making a comparison against the cost of the financing option.

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<sup>21</sup> \$10 million a year for 15 years discounted at 5%.

<sup>22</sup> Present Values rounded; calculated with Hewlett Packard 10B financial calculator; may differ slightly from Present Value table calculations.

If there were an infinite amount of appropriated funds, the ideal solution would be to fund this project upfront. However, a finite amount of funds is available for use in the federal government, as is the case in any corporation; therefore, every project can not be funded. This case is more of a question of: should we finance *or* do without the upgrade and forgo the future saving and increased efficiencies.

This financial analysis must be expanded to include the opportunity cost of a \$40 million project. Opportunity cost is a term used in economics to mean that the cost of an opportunity forgone (and the benefits that could be received from that opportunity), or the most valuable forgone alternative.<sup>23</sup> The lack of appropriated funds and the opportunity cost of spending the \$40 million upfront make a compelling argument for using innovative public-private partnership financing solutions.

While quantitative data help support a decision, it is important to look at the qualitative data such as the operational aspects of the project mentioned in the operational aspects section above. As mentioned previously, with the installation of a dual fiber ring communications network to SvalSat, transmission speed, bandwidth, and reliability of the system improved significantly.<sup>24</sup> Operational improvements of the new system must be taken into consideration.

Through Executive Order (E.O.) 13123, dated June 8, 1999, the Executive branch strengthened the government's position on private financing already authorized by Congress.

DOE and OMB shall also explore the creation of financing agreements with private sector suppliers to provide private funding to offset higher up-front costs of efficient products.<sup>25</sup>

The CEO of Hannon Armstrong, Jeffrey Eckel, noted, "By using this unconventional financing approach, Norway and the U.S. government were able to access a critical service without seeking new appropriated dollars from Congress."<sup>26</sup>

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<sup>23</sup>Wikipedia, the Free Encyclopedia; available: [http://en.wikipedia.org/wiki/Opportunity\\_cost](http://en.wikipedia.org/wiki/Opportunity_cost)

<sup>24</sup> The rate of transmission over this telecom satellite was approximately 48 million bits per second (Mbps) (as compared to the two 155 Mbps channels that NASA and NOAA will each be allotted for a total of 620 Mbps from the Project's cable capacity.

<sup>25</sup> Executive order 13123; Greening the Government Through Efficient Energy Management, June 8, 1999; Sec 403 (b) (4).

The authors of this project would agree that without the use of this innovative financing agreement, this necessary link would have been a “non-starter” and that would not be in the best interest of the American taxpayers and National Security. Mr. Eckel also said the deal is unlikely to create any contractual or legal precedents that would open the doors to similar deals in the industry; “it does show how new transactions could be conceived...frankly, that’s where the problem is; people don’t know that you can do this kind of stuff...it should be very interesting to Congress.”<sup>27</sup>

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26 Defense News; Finding Savings Up Front-Private Investors Finance Fiber-Optic Link Near Arctic Circle; Gopal Ratnam; Nov. 17, 2003; Vol. 18, No. 43.

27 Defense News; Finding Savings Up Front-Private Investors Finance Fiber-Optic Link Near Arctic Circle; Gopal Ratnam; Nov. 17, 2003; Vol. 18, No. 43.

### III. CASE STUDY TWO

#### A. ADAPTING ESPC MODEL TO MOBILE ASSETS

In this second case study, we examine another Hannon Armstrong financing arrangement. The subject is an adaptation of an existing contract model, the Energy Savings Performance Contract (ESPC), to mobile assets. If ESPCs were allowed to be applied to mobile assets, significant savings would result as demonstrated in the B-52H scenario below. In order to understand how the EPSC model can be adapted to mobile asset, it is important to first understand how ESPCs work. Therefore, we will first explore the ESPC model and then the B-52 Bomber scenario.

##### 1. History of the ESPC Legislation

The Energy Savings Performance Contract (ESPC) was originally authorized in the 1986 amendments to the National Energy Conservation Policy Act (NECPA) of 1978 (codified at 42 USC 8287). Congress created the ESPC concept as a tool for agencies to use in meeting conservation and efficiency goals for federal buildings. These goals were set forth in detail by various Executive Orders and directives requiring federal agencies to use 35 percent less energy by 2010 in comparison to 1985 usage levels.<sup>28</sup> The infrastructure improvements necessary to comply with these initiatives would require significant up-front funds. However, Congressional appropriations were not sufficient to cover the costs. Therefore, new creative financing partnerships with private sector firms would be imperative in funding the capital improvements necessary to comply with directives.

As mentioned above, Congress first authorized the use of ESPCs to upgrade federal buildings in the 1986 amendments to NECPA. But the general provisions of NECPA were made more specific and functional by the Energy Policy Act of 1992 (EPACT).<sup>29</sup> Later, in 1998, authority was extended through October 2003. Most recently, the Energy Policy Act of 2005, Section 105, extended the authority for all federal agencies to use ESPCs under section 801 of NAECA from October 01, 2003 until

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28 U.S. DOE DOE/GO-102003-1744 July 2003.

29 Energy Policy Act of 1992 (EPACT), P.L. 102-486.

September 30, 2016.<sup>30</sup> An increased public confidence in ESPCs has resulted in a significant ten-year extension of ESPC authority.

One of the most important documents regarding energy reduction was Executive Order 13123--Greening the Government through Efficient Energy Management, dated June 8, 1999. Through this E.O., the Executive Branch strengthened the government's position on private financing that was already authorized by Congress. The President encouraged private financing and defined requirements for agencies to meet specific energy reduction goals and most importantly, he supported the use of ESPCs to achieve them. An excerpt from Section 403 (a) is as follows:

Financial Mechanisms... Agencies shall maximize their use of available alternative financing contracting mechanisms, including Energy Savings Performance Contracts and utility energy-efficiency service contract, when life-cycle cost-effective, to reduce energy use and cost in their facilities and operations. Energy Savings Performance Contracts, which are authorized under the National Energy Conservation Policy Act, as modified by the Energy Policy Act of 1992, and utility energy-efficiency services contracts provide significant opportunities for making federal facilities more energy efficient at not net cost to taxpayer.<sup>31</sup>

E.O. 13123 also established the Federal Energy Management Advisory Committee (FEMAC). The purpose of the Committee is to provide the Department of Energy (DOE) with an independent view on enhancing energy management in the federal sector. The order directs FEMAC to address a range of issues, including how to improve the use of ESPCs and Utility Energy Service Contracts (UESCs), improve procurement of Energy Star® and other energy efficient products, improve building design, reduce process energy use, and enhance applications of efficient and renewable energy technologies at federal facilities.<sup>32</sup> Figure 6 illustrates the federal progress towards their standard building energy reduction goal.

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30 PL 109-58.

31 Executive order 13123; Greening the Government Through Efficient Energy Management, June 8, 1999; Sec 403 (b) (4).

32 Federal Energy Management Advisory Committee (FEMAC); Energy Savings Performance Contracts (ESPC)-Report on ESPC authority; Sep 08, 2004.

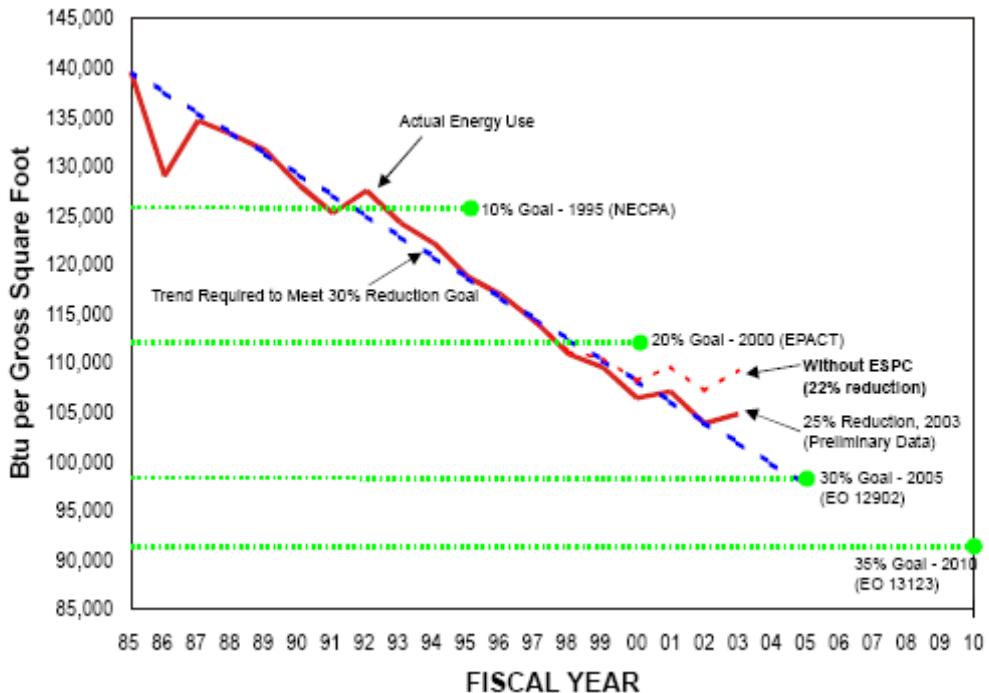


Figure 7: Federal Progress-Standard Building Energy Reduction Goal.  
 From annual data submission to FEMP by all federal agencies for its Annual Report to Congress on Federal Government Energy Management

## 2. How ESPCs Work

ESPCs are highly specialized federal contracts that allow the federal government to upgrade obsolete capital assets in the absence of capital appropriations. Energy service companies finance, install, and maintain new energy efficient equipment in government facilities. Energy efficient equipment such as lighting, boilers, chillers, etc., is installed to replace the currently installed inefficient capital assets. ESPCs are similar to “share-in-savings contracts,” which enable federal agencies to obtain capital more quickly than if they had to go through traditional appropriations. Agencies provide no capital upfront, because contractors finance the entire investment. But unlike most share-in-savings contracts, ESPC payments are capped in a way that the government realizes excess savings beyond the amount used to amortize the initial capital cost of the upgrade that produces that savings. Thus, the contractor bears all the downside risk of less-than-

expected savings, while the federal agency enjoys all the upside reward of better-than-expected savings. Truly, this is the best possible risk allocation for the federal agency and the taxpayer.

The main difference between ESPCs and operating leases is that ESPCs are paid from savings; another important difference is that federal agencies own the subject assets immediately under an ESPC. While both ESPCs and leases allow the federal government to avoid paying the total cost of an asset up front, under an ESPC, title transfers to the federal government as soon as the asset is accepted by the government. The familiar defense acquisition management acronym, Government-Owned and Government-Operated (GOGO) assets apply to ESPCs.<sup>33</sup>

Using an ESPC avoids the myriad of issues related to federal leases such as allocating risk of loss, insurance, restrictions on use, and disposition of the asset at the end of the lease. This important aspect of ESPCs means that ESPCs are most appropriate for assets that the Federal government intends to keep for the long term. This is why ESPCs have traditionally been used to upgrade assets that are permanently embedded in the infrastructure of federal installations. This is also why ESPCs generally require perhaps the most rigorous life-cycle cost analysis of any type of federal contract.

### **3. Cost/Savings to the Government**

The Alliance to Save Energy, a non-profit coalition of Energy Service Companies ESCOs and other groups, estimates that the federal government wastes \$1 billion each year on its buildings that use energy inefficiently.<sup>34</sup> Before the inception of an ESPC, the federal government used taxpayer dollars to pay for utility bills and operation and maintenance costs for federal buildings, which are often old and energy inefficient. Due to appropriated fund limitations, the lack of funds frustrates agencies' efforts to meet their energy efficiency, water conservation, and renewable energy goals.

At initiation of the ESPC, ESCOs recommend potential Energy Conservation Measures (ECMs), install the equipment, and then verify that the improvements yield

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<sup>33</sup> It should be noted, however, that ESCOs often provide long-term service and maintenance for the upgrades as an integral part of the ESPC.

<sup>34</sup> Alliance to Save Energy; Fact Sheet; Updated May 2005.

intended results. Financial services firms, such as Hannon Armstrong, raise the money for the capital improvements through private placement among various investors. Without ESPCs, agencies would have to reassess their budget plans to accommodate investments in ECM and/or Congress would be asked to appropriate funds to finance investments to meet currently required energy consumption goals.<sup>35</sup>

During the ESPC, the government pays for upgrades, with interest, out of the stream of savings generated by the upgrades over a period of time up to twenty-five years. By law<sup>36</sup>, the government pays no more than it would have paid for utilities if it had not implemented the ESPC. After the ESPC expires, the government keeps all of the savings, freeing up even more taxpayer dollars to be used for other priorities. The chart below graphically illustrates the Agency's cash flows before, during, and after the ESPC, as described in Figure 7.

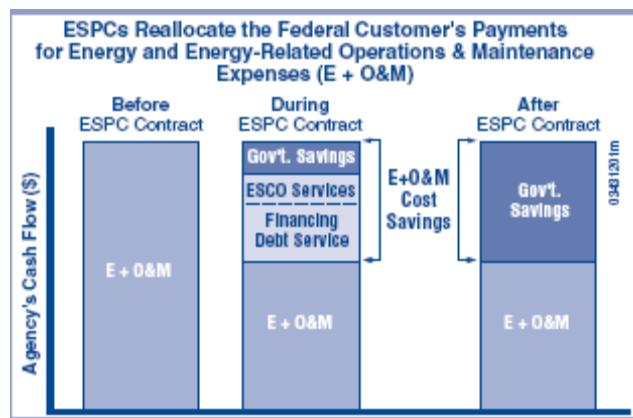


Figure 8: Agency's Cash Flows Before, During and After ESPCs  
From Federal Energy Management Program; DOE/GO-102003-1744 July 2003

#### 4. Risk Exposure in ESPCs

The primary reason for success of the ESPC lies in the unique allocation of risk in an ESPC. Simply put, it is the ESPC contractor, not the government, who bears the risk of generating savings to pay for the acquired assets over time. Moreover, if savings are generated in amounts that exceed the ESPC payments, the government retains all excess

35 GAO 05-55.

36 H.R. 6 signed into law by President Bush Aug 2, 2005; PL 109-58.

savings.<sup>37</sup> Under such conditions, it is hard to imagine how the federal government could lose. It is equally hard to imagine that any contractor would ever agree to an ESPC unless it had absolute confidence that the asset will generate the promised savings. The bottom line is that ESPCs work well for both the federal government and contractors because no contractor ever enters into an ESPC unless the promised benefits to the federal government are, for all practical purposes, a sure thing. However, it is also true that ESPCs allow the federal government to retain certain risks when it is logical to do so.

The most common risk retained by the federal government under an ESPC is the utilization rate of an asset. Even the most efficient asset cannot produce savings if it is not used and it is generally only the federal agency that controls how much or how little its assets are used. The federal government will therefore often stipulate the utilization rate of an asset in an ESPC. Such stipulations are also used in cases where actual measurement and verification of savings are too costly or otherwise impractical for the federal agency. Lighting systems in federal office buildings are perhaps the most common example of actual measurement and verification being impractical. It is far more efficient to simply “stipulate” the utilization rate at, say, eight hours per day than to install data capture technology at every light switch.

## **5. Historical Use of ESPCs**

While the Department of Defense alone contracted 60 percent of the projects and 70 percent of the investment dollars<sup>38</sup>, ESPCs have been used in 18 different federal agencies and departments in 46 states. This covers virtually every major federal installation. In all, over 300 ESPC transactions have been executed between the federal government and major US energy service companies such as Honeywell and Johnson Controls. The total value of these private-sector investments exceeds \$1.8 billion.<sup>39</sup>

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37 Federal Energy Management Program; DOE/GO-102003-1744 July 2003.

38 Produced for the U.S. Department of Energy by the Oak Ridge National Laboratory, a DOE national laboratory; ORNL 2005-02583/jcn July 2005.

39 Based on agency annual data submissions to FEMP from FY 1998 onward.. Produced for U.S. DOE by Oak Ridge National Laboratory, a DOE national laboratory ORNL 2005-02583/jcn July 2005.

These improvements save 14.4 trillion British Thermal Units (Btu) annually.<sup>40</sup> To get a sense of the scope of the Btus saved, you can equate that saving to 143,000 households or a city of a half million.<sup>41</sup> These projects will save the government \$5 billion in energy costs after \$3.5 billion of the savings are used to pay off project investments. Net ESPC savings to the government are \$1.5 billion.<sup>42</sup>

Initially, federal energy management projects were funded primarily through annual appropriations and innovative financing techniques such as ESPCs and Utility Energy Service Contracts (UESCs). However, the role of ESPCs and UESCs has become increasingly more important to the federal government as individual agencies struggle to maintain and improve the energy and water efficiency of their facilities to meet energy reduction, environmental, and energy security goals. This is especially true given the current increase in gas and oil prices and a major reason that use of ESPCs for mobile assets must be considered.

During the past four years, almost 80 percent of federal energy management projects were funded by alternative financing mechanisms. Data reveals that the federal government's use of ESPCs for energy conservation grew dramatically while appropriated funding for energy projects remained relatively constant or decreased. In the past five years, ESPCs accounted for 51 percent of the total federal investment in energy conservation, while appropriations accounted for only 23 percent.<sup>43</sup> The breakdown of federal spending by funding source to meet energy conservation goals is depicted in Figure 8.

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40 Determined by applying the FY2000-2003 average of 8000 Btu saved annually per dollar invested to the \$1.8 billion ESPC investment. ORNL 2005-02583/jcn July 2005.

41 The conversion to households is derived from EIA Annual Energy Outlook 2005, Table A4. ORNL 2005-02583/jcn July 2005.

42 Savings total is based on guaranteed savings (2.196 times investment per FY2000-2003 data); plus additional savings not guaranteed (ESCOs generally guarantee a conservative 95% of estimated savings); and 3 years of equipment service life after payments to ESCO end. ORNL 2005-02583/jcn July 2005.

43 Federal Energy Management Advisory Committee (FEMAC); Energy Savings Performance Contracts (ESPC)-Report on ESPC authority; Sep 08, 2004.

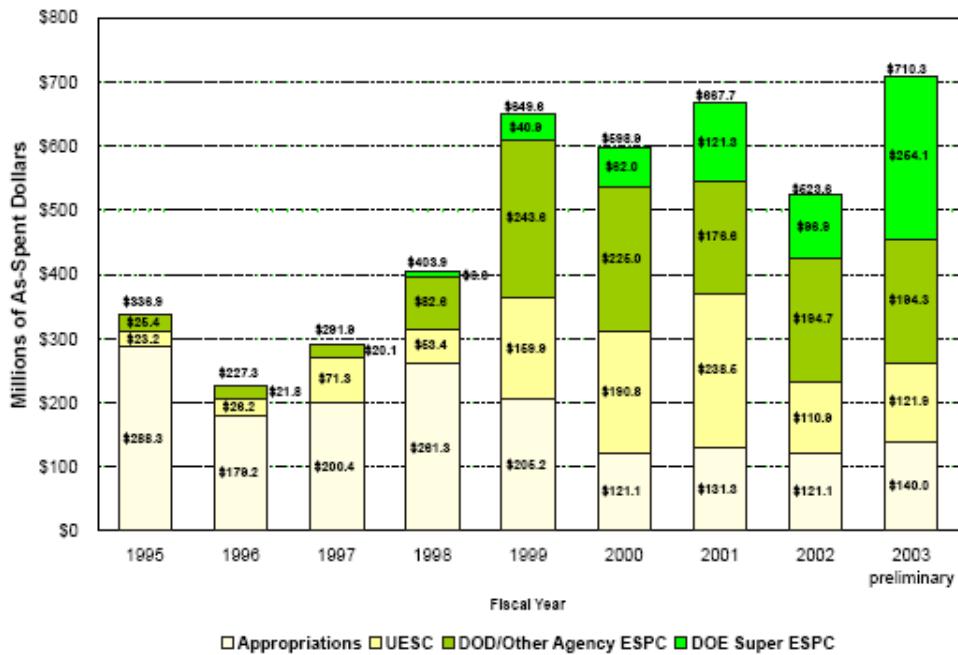


Figure 9: Federal Spending by Funding Source to Meet Conservation Goals, 1999-2003  
 From: Federal Energy Management Advisory Committee (FEMAC); [Energy Savings Performance Contracts \(ESPC\)-Report on ESPC authority](#); Sep 08, 2004

Super ESPCs are listed in Figure 8; therefore, we will briefly describe a Super ESPC. Awarding a stand alone ESPC can be very complex and time consuming. Recognizing this, the U.S. Department of Energy's Federal Energy Management Program (FEMP) created streamlined Super Energy Saving Performance Contracts (Super ESPCs). Similar to other Federal "Indefinite-Delivery / Indefinite Quantity" (IDIQ), Multi-Awardee contracts, these "umbrella" contracts allow agencies to undertake multiple energy projects under the same contract.<sup>44</sup> Using a Super ESPC is the preferred route over a traditional ESPC because of the streamlined process. While Super ESPCs are an important part of the building ESPC contracting world, they are not relevant to potential mobile ESPC assets. Aside from Honeywell, no Super ESPCs ESCO would be a likely player in the mobile ESPC market. Also, the main reason Super ESPCs are so well suited to facility upgrades is that projects are generally small and site-specific. In

44 U.S. Department of Energy - Energy Efficiency and Renewable Energy; Updated 12/08/2005; [www.eere.energy.gov/femp/financing/superespccs.cfm](http://www.eere.energy.gov/femp/financing/superespccs.cfm); accessed Mar 04, 2006.

contrast, mobile ESPC projects would likely be so large that they would almost certainly be “one-off” contracts.

In the decade-long Federal experience with ESPCs, these contracts have a significantly better record of success than the overall Federal contract experience. There are no “Terminations for Default” on record and the few “Terminations for Convenience” cases have been generally precipitated by Federal agencies using end-of-year excess funds to “buying out” well-performing ESPCs.

Note that there have been a handful of “Termination for Convenience” cases where the underlying asset was lost, such as a GSA building located near the World Trade Center that was destroyed on September 11, 2001. This provides a useful example of how an ESPC is an appropriate and robust contracting model for upgrading combat aircraft that could be lost to enemy fire or accident.

## **6. CBO and OMB Views of ESPCs**

While the Office of Management and Budget (OMB) considers the ESPC program to be “budget neutral” and says it “saves the government money”<sup>45</sup>, the Congressional Budget Office (CBO) has a different view of ESPCs. Although CBO had considered ESPCs to be budget neutral since their creation by Congress, in 2003 CBO reversed their policy just as Congress was considering ESPC reauthorization and expansion.

CBO was created by Congress to quantify, or “score” the net cost to taxpayers of every bill that is considered by Congress. So unlike the Executive Branch’s OMB, which scores actual government obligations in “real time,” CBO only investigates when legislation is proposed and Congress wants an estimate of its cost to taxpayers.<sup>46</sup> Thus, when Congress first authorized the use of ESPCs to upgrade federal buildings in 1992, CBO correctly viewed ESPCs as budget-neutral and scored the program at zero cost.

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<sup>45</sup> Alliance to Save Energy; Fact Sheet; Updated May 2005.

<sup>46</sup> The cost, or score, of appropriations bills are relatively easy to estimate, since the dollar amounts are set forth in great specificity. But “Authorization Bills” are more challenging, since it is unknown whether appropriations will follow the authorization and to what extent a discretionary program (such as ESPCs) will actually be used by the Executive Branch. CBO deals with these unknowns by assuming full appropriations and projecting discretionary usage based on historical patterns.

Again, in 1998 when Congress reauthorized the ESPC program for an additional five years, CBO again scored the program at zero.

However, when a new Energy Bill was introduced in early 2003, CBO reversed over a decade of precedent and scored the ESPC legislation as direct spending,<sup>47</sup> refusing to consider the savings that offset any government payment, even though payments and savings under an ESPC are a mathematical identity. The reason was that CBO viewed the savings as “discretionary” spending. Now that the CBO scored the payments as direct spending and the savings as discretionary spending (not scored), ESPCs were no longer considered “budget neutral” by the CBO. Because of such accounting fictions, the savings that accrue over time are not counted at all. This new CBO scoring policy is illogical because no payment can ever be made unless savings in an equal or greater amount occur first. But despite the flawed logic, few members of Congress will vote for a measure that appears to be a “budget-buster.” Moreover, CBO was designed to be the honest broker in budget matters so many members of Congress respect the independent “referee” role of CBO, even when they disagree with the “ref” on a specific call. This is not to say that CBO is never overruled; only that it is infrequent. When it does occur, it is generally at the specific direction of the House and/or Senate Budget Committee Chairmen, to whom CBO reports. Fortunately, despite the view of the CBO, the Energy Policy Act of 2005 passed, and this extended the authority for all federal agencies to use ESPCs under section 801 of NECPA from October 1, 2003 until September 30, 2016.<sup>48</sup>

As a result of constrained resources, ESPCs and PPPs involving third party financing are becoming more prevalent. The appropriation process is time consuming and funding for “low-visibility” projects is increasingly rare. The use of third party financing allows for funding of projects that would otherwise not get funded. Hannon Armstrong’s funding of a fiber-optic system in the Arctic Circle is one example of the successful use of third-party financing for an asset-class that has not traditionally been contracted for in this way. Analyzing and understanding how the application of third-

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<sup>47</sup> CBO counts the total obligation to the government when the contract is signed.

<sup>48</sup> PL 109-58 the passed bill with ESPC reauthorization despite CBO’s adverse scoring of the measure at \$2.9 billion. See, <http://www.cbo.gov/showdoc.cfm?index=6581&sequence=0>

party financing to a government project results in cost savings is an important element to applying ESPC to another asset class that has not traditionally been contracted for in this way: mobile assets. The next few sections will outline the B-52 Bomber aircraft re-engining project and how the ESPC model could benefit this effort.

## **7. Applying the ESPC Model to the B-52H**

Applying the same innovative methods of financing used in the fiber-optic cable project to mobile assets is a key proposal of this research. In the following sections we will examine using an ESPC to fund the B-52H re-engining project. If ESPCs were allowed to be applied to mobile assets, the resulting savings would be much more significant than all savings to date under the program. This is demonstrated in the following analysis of reengining the U.S. Air Force's fleet of B-52H bombers.

## **8. Introduction to the B-52H Scenario**

In 1996, Boeing submitted an unsolicited bid to re-engine the United States Air Force's (AF) aging B-52H fleet. The proposal was rejected because it was determined to be not cost effective for the Air Force. The estimated payback period for the re-engine program was 36 years which was not deemed economically acceptable. In a study prepared by Boeing and the AF, several reasons were listed as to why the program could not be justified:

1. A constant fuel price calculated at the Defense Energy Support Centers annual rate.
2. The AF estimated that the depot costs of maintaining current engines would remain stable and never exceed \$299,000 per year through year 2037.
3. Savings were not calculated for reduced refueling that would not be needed.
4. Funding did not compete against higher priority programs.
5. Premature retirement and reductions in force were considered program risks.<sup>49</sup>

Clearly, these AF assumptions made accepting a long-term proposal such as this nearly impossible. Premature retirement and fleet reductions are legitimate factors that should be considered, but by assuming that fuel and maintenance costs would remain

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<sup>49</sup> The US Air Force and the Boeing Company, B-52H Re-engine Study: Summary of Findings (Tinker AFB, Oklahoma, 2003) 2-1.

stable over a 40-year period and not allowing for cost savings from reduced refueling needs, the AF allowed itself to reject the proposal.<sup>50</sup>

In 2002, the Defense Science Board (DSB) released a report, which supported and recommended the Boeing plan as a way to upgrade the fleet of B-52H's. This report was subsequently updated and re-released in 2004. They developed a list of seven conclusions as to why the re-engining plan should be accepted:

1. The B-52H is the most versatile and cost effective bomber in the AF fleet.
2. The B-52H is the only platform capable of launching Conventional Air Launched Cruise Missiles (CALCM) in the inventory.
3. Further reduction in the B-52H fleet is not likely.
4. The re-engining program has low technical risk.
5. The plan gives the B-52H fleet greater operational range, reduces fuel burn and tanker demand, and reduced maintenance costs.
6. The program could be used to further the use of Energy Savings Performance Contracts (ESPC) into mobile assets such as weapon systems.
7. The AF task force determined that the benefits of the re-engining program outweighed the cost associated.<sup>51</sup>

The two different views establish the basis for the debate on whether the B-52H fleet should be re-engined, and if so, how does the United States Congress pay for the cost.

## **9. The Economic Aspect of the B-52H Re-engining Program**

When examining the economic benefit or detriment of the re-engining program, specific focus must be given to several key costs. The analysis provided by the DSB task force lists these cost items and the estimated values to be used in the analysis.

Fuel Cost: The AF allocates 22,000 flying hours for the B-52H fleet. The current engines use a total of 3,310 gallons of fuel per hour. Through re-engining, the AF team has concluded that the aircraft will use 33 percent less fuel, or a total of 2,218 gallons per flying hour. This efficiency can save the AF about 24 million gallons of fuel over the

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50 B52-H Re-engine Study. 2003, 2-1.

51 B52-H Re-engine Study. 2003, 2-3.

course of a year and approximately 840 million gallons over the remaining 35 year life of the airframe. The task force used the \$1.20 per gallon figure from DESC to conclude the AF could save about \$29 million annually on fuel costs which translates into about \$1.0 billion over the remaining life of the B-52H fleet. However, the \$1.20 number is an accounting simplification and does not take into account logistical assets needed to move, pump, or refuel from the air.<sup>52</sup> Obviously, with the current rise of fuel prices, this number appears to be more off target than was once thought.

The cost for refueling from tanker aircraft is significantly higher due to more of a logistical footprint. At the request of the task force, the price per gallon of fuel received from tanker aircraft was calculated by the Air Force Cost Analysis Improvement Group (CAIG). They determined the refueling cost at \$17.50 per gallon (1999 dollars). The task force determined that, by increasing fuel efficiency, the AF would realize direct monetary savings from reducing the amount of fuel required by the B-52H fleet in flight. This information was not taken into account when the AF made the decision to forego the Boeing offer.<sup>53</sup>

When this information was placed into a tanker requirements model used by the AF, it was determined that the AF could refuel its current fleet with 55-83 fewer tanker aircraft. The AF would realize some cost savings due to aircraft retirements from inventory or the extra aircraft could be used to support other missions that currently would not have been funded. These savings may indeed be all the more critical since in July 2002, the Air Mobility Command, the major command which controls the AF tanker assets, stated that 500-600 tankers were needed in the fleet to ensure continued operations given realistic scenarios that could face the AF.<sup>54</sup> Keep in mind that savings generated are still savings, even if the savings are immediately spent fulfilling the next highest critical priority. Viewed another way, the critical shortfall in tankers can be addressed through “demand-side” measures as well as “supply-side” acquisition of additional tanker aircraft.

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52 Defense Science Board Task Force, B-52H Re-engining (Washington, DC, 2004) 3-5.

53 B-52H Re-engining. 2004, 5.

54 B-52H Re-engining. 2004, 4-5.

Engine Depot Overhaul Cost: The report Boeing offered to the AF in 1996 estimated a complete engine overhaul to cost \$426,000. The AF believed this number was extremely high and in its own cost analysis used \$257,000 as the cost to overhaul a TF33-103 engine. The task force that revisited this information found that in 2002, engine overhauls cost an average of 539,000. Prices rose to \$710,000 and \$832,617 in 2003 and 2004 respectively. The profoundly flawed under-estimation of future engine overhaul cost was yet another incorrect factor that led to the AF turning down the initial proposal from Boeing.<sup>55</sup>

In an effort to try and forecast the costs of depot overhauls, the DSB developed the chart in Figure 9 to show the costs of depot maintenance on the TF33-103 engines through the remaining life of the B-52H fleet.<sup>56</sup>

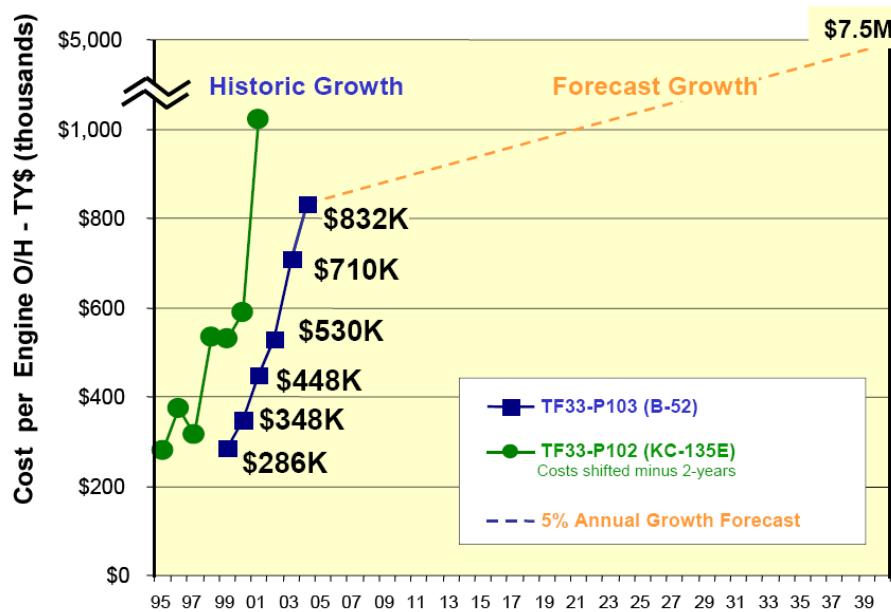


Figure 10: Forecast of the Costs of Depot Overhauls  
From: Defense Science Board's proposal to accept the re-engining plan

The depot directorate adjusted maintenance numbers based on the historic trend of price increases. The growth rate of costs was changed from 2 percent above inflation to 5 percent above inflation. One need only look at the graph above to see that the

55 B-52H Re-engining. 2004, 5-7.

56 B-52H Re-engining. 2004, 6.

forecast growth of future costs is a triumph of hope over experience. Nevertheless, even with the numbers presented in this model, the cost of an engine overhaul in the final years of an aircraft's life approaches \$7.5 million.<sup>57</sup>

Boeing has stated that due to recent increased technological advances the current engine that can be equipped on the B-52H fleet can be a "hang and forget" engine. This means that the life of the engine, before it needs to be removed for maintenance, is longer than the remaining life of the airframe. This could generate a significant cost savings to the AF that was ignored in the 1996 review.<sup>58</sup>

Engine Field Maintenance Cost: The AF also maintains about 70 engines in the field per year. These field overhauls cost the AF \$462,400 each or about \$32 million total cost per year. Boeing estimated that through re-engining, the AF could lower this cost to about \$13 million and save approximately \$1 billion over the remaining life of the B-52H fleet.<sup>59</sup>

Annual Air Frame Usage Cost: In 1996, when Boeing first introduced the proposal, the AF estimated that a normal B-52H aircraft would fly about 350 hours per year. Since then much has changed and the aircraft are flown more than anticipated. During 2003 and 2004, the B-52H flew nearly an extra year per airframe to perform necessary operations. This increase in hours has the potential to change the estimates calculated by Boeing and the DSB task force. If the fleet is being flown more in the near term, it may prove to be more advantageous to upgrade as soon as possible as older equipment may not be able to stand up to the rigors placed on it.<sup>60</sup>

## **10. The Operational Aspect of the B-52H Re-engining Program**

While ESPCs ensure that upgrades will never be worse than cost-neutral, it is the operational advantages of the upgrade that motivate any use of ESPCs. If the B-52H re-engining project is approved, the current fleet will have a tremendous increase of operational effectiveness. With greater fuel efficiency, the aircraft will have a much

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57 B-52H Re-engining. 2004, 7.

58 B-52H Re-engining. 2004, 7.

59 B-52H Re-engining. 2004, 7.

60 B-52H Re-engining. 2004, 7.

greater range, reach, and loiter capability. The DSB task force defined “range” as the distance an aircraft can fly without being refueled. “Reach” is the sum of the distance an aircraft can fly without refueling and the distance its weaponry will travel. Essentially, reach is the distance a platform can travel to strike a target. “Loiter” is the time an aircraft can stay over a target to perform a mission without the need for refueling.<sup>61</sup>

The current range of a loaded B-52H is 5,088 nautical miles. Under the Boeing plan, this will increase to 7,420 nautical miles. The data in Figure 10 is from the Defense Science Board’s proposal to accept the re-engining plan. It shows that with the 46 percent increase in range, the re-engined B-52H’s are able to fly from Diego-Garcia Airbase to Kabul and Baghdad without refueling. Also, the re-engined planes will have over four hours loiter time at Kabul and about three hours loiter time for missions at Baghdad. This will greatly reduce the number of sorties needed from tanker aircraft and help to free up space on the ramp.<sup>62</sup>

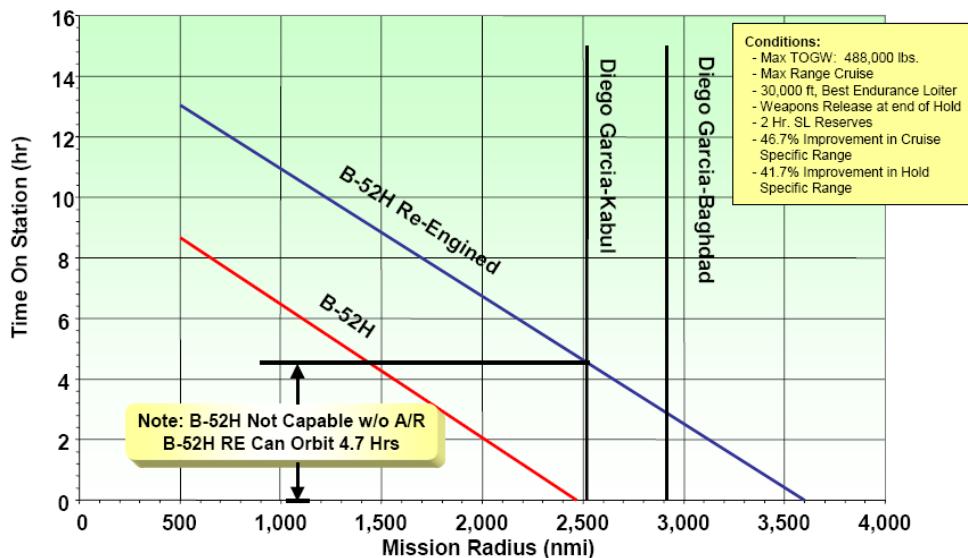


Figure 11: Unrefueled Diego Garcia to Kabul and Baghdad  
From: Defense Science Board’s proposal to accept the re-engining plan

With re-engining, a fully equipped B-52H will be able to use runways that are 20 percent shorter than the 7,600 feet that it currently needs. However, a re-engined B-52H

61 B-52H Re-engining. 2004, 24.

62 B-52H Re-engining. 2004, 24, 25.

will need a runway 175 feet wide as opposed to the current required width needed of 150 feet. The impact of this width requirement is unknown by the authors at this time; however, it is expected to have minimal impact on the operation capacity of the B-52 fleet. In addition, a bomber fleet with an increased range will also allow the AF to use less forward operating locations (FOL) and reduce the need for host nation support during times requiring military operations.<sup>63</sup>

### **11. The Environment Aspect of the B-52H Re-engining Program**

There are also environmental factors that would be affected by a re-engined B-52H fleet. The AF would realize a reduction in air and noise pollution. Currently, B-52H engines do not meet International Civil Aviation Organization (ICAO) standards for emissions whereas the re-engined planes would meet clean air standards with regard to smoke and fuel venting. Community noise factors will be reduced considerably under the re-engining program. It is expected that the newer engines will reduce noise by about 12 EPNdB which will bring the B-52H into compliance with Stage III noise standards.<sup>64</sup>

Even with these improvements, there is a negative aspect with regards to the environment. While it is true the re-engined B-52's will use less fuel and cause less noise, the nitrogen oxide (NOx) emissions will nearly double. While the other pollutants are reduced by 30 percent, NOx levels increase two fold. The net impact on the environment due to emissions cannot be determined.<sup>65</sup>

### **12. Risks Associated with the Re-engining Program**

There is a significant risk involved with re-engining these aircraft. The new engines that are being considered are 500 to 600 pounds heavier than the existing engines. However, they add about 9,000 pounds of thrust per engine. The total weight these newer engines are expected to add to the airframe is about 5,400 pounds. Also, the wings must be altered. There are ways to handle this impact, such as adding an auto-rudder to the tail of the plane. There are also other adjustments that would need to be made in other systems that arise from the addition of improved engines. These

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63 B-52H Re-engining. 2004, 26.

64 B-52H Re-engining. 2004, 30, 31.

65 B-52H Re-engining. 2004, 30, 31.

modifications will also cost money and should be factored into the cost savings when exploring the re-engining proposal.<sup>66</sup>

The threat of B-52H retirement is an issue that needs to be evaluated carefully. Ignoring the financial aspect and looking solely at the operational capability of the B-52H fleet, they could be operational through 2040. The average plane logged 14,700 flight hours in 1999. Boeing estimates that a B-52H should fly between 32,500 and 37,500 hours in a lifetime. As you can see from the graphic in Figure 11, most integral parts of the B-52H still have a long life ahead of them.<sup>67</sup>

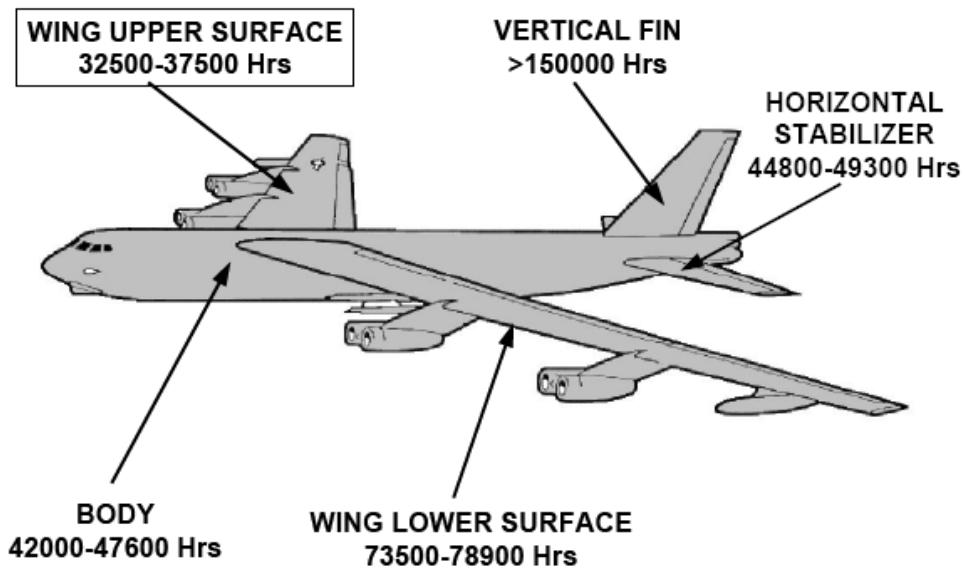


Figure 12: Economic Life of B-52H Structure

The study also assumed that the AF bomber fleet would remain at 208 including 94 B-52Hs. Today, the AF still operates a fleet of 94 B-52Hs,<sup>68</sup> although there is

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66 B-52H Re-engining. 2004, 32-35.

67 B-52H Re-engining. 2004, 13.

68 The current fleet of 94 B-52Hs is comprised of two components. The primary component of 76 B-52Hs is the fleet size for which the AF routinely requests funding from Congress. The second component of 18 “attrition reserve” B-52Hs is routinely funded via a Congressional “plus-up” that is above and beyond the funding requested by the Executive Branch. The common belief is that the North Dakota Congressional delegation is the political force behind this annual budget supplement and, to be sure, the importance of Minot Air Force Base to the North Dakota economy is significant and the basing of 18 B-52Hs at Minot helps ensure this base remains active. Having said that, some believe that the Air Force values the additional 18 aircraft and has come to rely on the Congressional champions’ annual efforts to give the Air Force more than DOD or the White House would likely support.

occasional debate over whether this should be reduced. As of March 2006, the Air Force has proposed reducing the B-52H fleet to 56, provoking an immediate Congressional reaction.<sup>69</sup> But even if the B-52 fleet is reduced, it is important to emphasize that a smaller fleet actually increases that economic benefit of reengining.

The key justification for any upgrade of a legacy asset is that the asset will be utilized at a rate that results in the upgrade's benefits exceeding the upgrade's costs. In the case of the B-52, the benefits of reengining are based on total fleet flight hours while the costs are based on the number of aircraft reengined. If the number of aircraft in the fleet is reduced, the cost of reengining the fleet is reduced. As long as the total number of flight hours of the fleet remains a function of military requirements, the only effect of a smaller fleet is that each aircraft will be utilized more, making reengining more, rather than less, compelling. Even in an extreme case where the fleet might be too small to fulfill the military requirement demands, reengining those few aircraft would make more sense than ever, since utilization would be maximized. Finally, it is essential to emphasize that this risk is common to any acquisition method that might be used to reengine the B-52 fleet, whether financed or not.

### **13. Financing Options**

Conventional Acquisition: This is the conventional model for Department of Defense purchases. The Air Force would use 3010 Procurement Appropriations from Congress to pay for the new engines. Assuming that this model would put reengined B-52s into service at the same time as other alternatives, this would be the least cost method as it would reduce payment of interest rates of leases or other financing methods to the lower US Treasury interest rate. The AF would purchase the engines outright and risk of future non-performance would, in all probability, be divided between the contractor and the AF under warranty terms commonly used in other conventional acquisitions. A purchase of this size would most likely mean that Congress would have to borrow money, thus increasing the size of the national debt. This would cause the interest

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<sup>69</sup> On March 16, 2006, the Senate passed a provision that effectively blocked any reduction in the size of the B-52 fleet. See Senate Amendment 3139, which amends Senate Concurrent Resolution 83 (Budget Resolution of Fiscal Year 2007). Both measures passed the Senate on March 16, 2006.

payments on national debt to increase, effectively offsetting some of the cost savings associated with this method.

Lease: This method involves payments to a contractor or financing institution over a finite period of time for use of the asset, in this case the B-52H engines. Leases can offer a variety of benefits to lessees; however, many of these are not applicable to the federal government. The government is not able to take advantage of the tax breaks that are associated with leasing, nor does it benefit from a reduced near-term money flow because the federal government theoretically has access to the money it needs.<sup>70</sup> The lessor is also not able to take advantage of tax breaks and pass on savings to the government in the form of lower lease payments.

Hourly Rate: The Navy uses this method of contracting for buying engine maintenance and commercial airlines routinely pay for maintenance and engine usage under a single “Power by the Hour” contract. Nevertheless, a pure commercial-style “Power by the Hour” is neither currently in use nor has it been used by the military in the past.<sup>71</sup>

ESPC: As mentioned previously in this research, ESPCs facilitate immediate ownership of assets while paying for the assets out of the savings the assets produce over time. Because ESPCs are not dependent on Congressional budget cycles for capital appropriations, upgraded assets are fielded much faster under ESPCs. The savings harvested in those years would otherwise be lost forever and represent a significant offset to the higher interest rate of ESPC as compared to US Treasury borrowing rate.<sup>72</sup> The other unique aspect of ESPCs is that the risk of asset non-performance is shifted to the contractor for the entire contract period (up to 25 years), rather than the standard warranty used in conventional acquisitions. In such warranties, both the time in which the contractor assumes risk of non-performance and the scope of performance covered is so limited that there is essentially no comparison with the performance guarantee of an ESPC.

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70 B-52H Re-engining. 2004, 37, 38.

71 B-52H Re-engining. 2004, 41.

72 B-52H Re-engining. 2004, 38-41.

#### **14. How Can ESPCs be Used to Re-engine the B-52H Fleet?**

ESPCs have not been used to finance mobile assets in the past because the law that created ESPCs limits their use to facilities. Nevertheless, the Defense Science Board, the Air Force, and Boeing (the original manufacturer of the B-52) all have studied reengining the B-52 fleet using the ESPC model. All studies found that B-52 reengining under an ESPC was a compelling alternative should Congress modify the law to permit such an application of ESPCs. Under this scenario, a private financing firm pays for the engines (including any required non-recurring engineering and installation) up front and turns them over to the AF in exchange for payments over time. These payments are made from savings realized by the AF in reduced fuel and maintenance costs. After the term of the contract ends, all subsequent savings are retained by the AF – whether or not the savings produced during the contract term were sufficient to pay off the cost of reengining. Again, the contractor guarantees the savings, so if the savings fail to materialize, the government is not liable for payments to the contractor. This is because the contractor can only, by law, be paid from savings that result from the upgrades installed under the ESPC. This puts the pressure squarely on the contractor to perform up to its guarantee.<sup>73</sup>

The studies all agree that new legislation would be required in order to use ESPCs for mobile assets such as B-52 reengining. While Executive Order 13123 could be interpreted to encourage application of ESPCs to mobile assets, this interpretation is generally considered to be inconsistent with the ESPPC statutory provisions. Since an Executive Order cannot change a statute (an act of Congress under its Constitutional power to create laws), it is safe to assume that in any case Congressional action would be needed before ESPCs could be used to upgrade mobile assets.

A second aspect that deserves mention is that measuring savings in traditional ESPCs is relatively simple, but measuring savings in mobile ESPCs can be more challenging administratively. The reason is that most military facilities using ESPCs have a single budget account from which all energy and maintenance expenses are drawn. Thus, if an ESPC produces energy and maintenance savings, it is a simple matter to pay

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<sup>73</sup> B-52H Re-engining. 2004, 38-41.

the ESPC payment out of that same single account. But a mobile ESPC upgrade like B-52 reengining will generate savings in multiple budget accounts. For example, fuel is saved not only through reduced consumption in the new engines of the B-52, but there is also fuel saved through reduced demand for tanker aircraft to carry fuel to the B-52s for mid-air refueling.

Congress has made clear that any upgrade's cost savings analysis (regardless of how that upgrade is acquired) must fully consider the cost of delivering fuel.<sup>74</sup> Thus, the B-52 fuel and maintenance savings would be supplemented by the tanker aircraft fuel and maintenance savings, a completely different budget account. This is even more administratively challenging since tanker aircraft are in such high demand that it is almost certain that tanker resources freed up by less B-52 demand would be immediately re-directed to other priorities. In other words, the savings generated by B-52 reengining would be immediately spent elsewhere. Inconvenient though this accounting may be, it is required by law whether conventional acquisition methods are used or another alternative is used. Moreover, a strong reminder of priorities is called for at this point: If reengining the B-52 fleet provides better warfighting capability while also providing better taxpayer value, the accounting system needs to conform to warfighter and taxpayer interests, not the other way around.

There are also some other issues associated with the issuance of an ESPC for use on a mobile asset of this type. Because the engines would be owned by the government, no revisions must be made for insurance, as would be the case if leased or procured under a "Power by the Hour" contract. However, the question remains what happens if a reengined aircraft is destroyed. Here the experience of the GSA building that was upgraded under a traditional ESPC and destroyed on September 11, 2001 is relevant. The government could simply continue to make payments as if the assets were not destroyed or it could pay a termination liability lump-sum payment to close out the matter. In the case of this GSA building, the government continued making payments for about six

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<sup>74</sup> See P.L. 107-107.

months and then terminated the contract for convenience, paying a lump-sum amount to the contractor in accordance with a termination liability schedule incorporated into the original contract.

A mobile ESPC would actually offer additional flexibility, since unlike buildings, mobile assets can often “take up the slack” of a lost asset. Thus, the total flight hours of a fleet of X aircraft can often be redistributed among (X-one) aircraft if one is lost. As mentioned above, savings are generated by total utilization which is a function of the total fleet flight hours consumed. Thus, real savings actually would not be reduced by a marginal decrease in aircraft, but only by a decrease in total fleet flight hours.

Clearly, the government is looking to purchase commercial off the shelf (COTS) engines for use on a military aircraft. These engines have not been designed to military specifications and would need to be “hardened” to military specifications – at least to the point that the 1950s TF-33 engines were “hardened.” The contractor will assume this risk, since ESPCs provide no means of shifting this risk or cost to the government? Fortunately, the major commercial aircraft engine original equipment manufacturers (OEMs) are also the major OEMs of military engines for DOD. Therefore, issues of converting COTS engines for use on B-52s is well within the expertise of these OEMs and is probably a risk that the government should insist be borne by the contractor even if reengining occurred under a conventional acquisition. In any case, the issue is common to all potential methods to fund the re-engining program.

## **15. Should ESPCs be Used on the B-52H?**

The B-52H fleet is in need of engine upgrades. Many of the planes have the original engines from the 1950's that are still functional but grossly inefficient when compared to the technology available in modern engines. You will not be able to find many who dispute this fact. The major problem arises when discussions are held as to how to pay the bill. While there are several methods of financing that could be appropriate for this transaction, the one method that stands out as being both feasible and economical is the ESPC method.

If an ESPC is used for the purchase of new engines for the B-52H fleet, the engines should be available in the short term without a huge outlay of funding from the

Congress. This will allow the AF to strengthen its forces for current threats, as well as future threats that may arise. While the method would be slightly more costly than an outright purchase, the delivery time saving is a huge benefit, both in terms of capturing near-year economic savings and providing warfighters increased combat capability sooner.

The DSB task force conducted a net present value (NPV) analysis concerning the B-52H re-engining program and came out with favorable results supporting the program. They used the following assumptions through years 2004-2037:

- 2004 depot engine price of \$832,617
- Depot price growth rate of 5%
- OMB inflation index of 1.9%
- FY96 EMD and production costs of \$3.2B
- 30 year OMB nominal discount rate of 5.5%.<sup>75</sup>

The chart in Figure 12 shows the results of the NPV calculation following OMB guidelines:

	<b>Current Outlay</b>	<b>Outlay After Re-Engining</b>	<b>Outlay Reduction</b>
<b>Fuel Purchase</b>	\$1,774M	\$1,346M	\$429M
<b>Depot Purchase</b>	\$3,136M	\$394M	\$2,743M
<b>Field Maintenance</b>	\$657M	\$369M	\$288M
<b>Total</b>	\$5,568M	\$2,108M	\$3,459M
<b>Program Cost</b>			\$3,195M
<b>Net Present Value</b>			\$264M

Figure 13: Estimated Change in Direct O&M Outlays with Reengining  
From: DSB task force

The numbers show that the program will have a positive NPV at the 5.5% discount rate. This is derived from calculating the difference in cash flows from the current outlay and outlays after re-engining of future years of fuel, depot maintenance, and field maintenance. The cost of the program is then subtracted from this number to get the present value of the program. The positive NPV shows that the program would be economically beneficial to the AF to re-engine the planes to save money over time. This

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<sup>75</sup> B-52H Re-engining. 2004, 10.

clearly is not the only measure that should be used to decide on financing. However, this measure should not be taken lightly.

While it is also true that further retirement of B-52H's is a major risk factor, this should further push the AF to upgrade their fleet. With the current number of 94 aircraft in the B-52H inventory shrinking in the foreseeable future, these aircraft will need to be more and more reliable as the total fleet flight hours will not likely change significantly in the near term. Fewer planes mean that the flight hours per plane will probably increase. These aging aircraft have a chance to maintain a higher operational availability rate if more modern, technologically advanced engines are in place.

The B-52H has been one of the most versatile and battle-tested aircraft of all time. These planes have been flying since the 1950's and current plans call flying them until at least 2038. Various upgrades have been made over the years to allow them to continue battlefield domination and this endeavor is yet another upgrades. With more modern engines, the B-52H fleet will have less fuel burn, greater thrust, and more operational reliability. The only hold-up to making this a reality is the question of how to fund it.

There are methods that can be used that are alternatives to the conventional approach. One of these methods, the ESPC method, proves to have great benefit to the AF. It's a win-win. The AF gets engines it needs now, and pays for them over time through savings accumulated through increased efficiencies over the older engines. While this method has never been used on a platform such as this in the past, it is a method that should not be overlooked. It has substantial merit and should be given full consideration as the preferred method to upgrade the B-52H engines for now, and the future.

## **16. Application of ESPC and Mobile Assets**

As was discussed above, historically, ESPCs have been used to reduce the energy consumption of federal facilities. In 254 ESPCs awarded from 1999 to 2003, all were used to modernize government facilities.<sup>76</sup> Current Congressional legislation limits the use of ESPCs to publicly owned buildings with no provisions given to mobile asset. A

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<sup>76</sup> Government Accountability Office. (June 2005). Energy Savings: Performance Contracts Offer.

recent report by the Federal Energy Management Advisory Committee (FEMAC) urges Congress to adopt pilot programs or temporary authority to test the use of ESPCs to reduce energy costs with mobile assets.<sup>77</sup> A number of attempts to include legislation to authorize the use of ESPCs for mobile assets have failed to muster support. In renewing the expired ESPC authority, Congress merely amended expired legislation by extending the program to 2016. With higher fuel costs and a large portion of the federal government's energy consumption attributed to operating mobile assets, energy savings contracts would be a viable solution.

## **17. Legislative Changes**

Current legislation governing energy savings contracts would have to be amended in order for federal agencies to pursue external funding sources for modernization of mobile assets. In 2003, a bill was proposed (H.R. 3339 National Defense Savings Act of 2003) giving the DoD more flexibility in pursuing energy savings. This bill would have allowed the DoD to initiate ten pilot programs to determine the feasibility of applying ESPC to mobile assets. In the two years that this legislation was introduced within the Congress it did not make it into law. Support for applying ESPCs is not only lacking in the Congress, but in OMB as well. In a statement identifying concerns regarding a legislative proposal to include ESPC use to mobile assets, OMB stated:

The Administration would object to the movement of the Energy Savings Performance Contracts (ESPCs) authority from DOE to DOD. In addition, we would oppose the expansion of ESPC authorities to non-building applications since it is inconsistent with federal fiscal and procurement policies. The Administration supports immediate extension of current ESPC authority for all agencies.<sup>78</sup>

Beyond just legislation, federal fiscal and procurement policies will also have to be amended to accommodate mobile assets. Though the opposition to doing so may seem

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<sup>77</sup> Federal Energy Management Advisory Committee. (September 8, 2004). Energy Savings Performance Contracts (ESPC): Report on ESPC Authority. Washington DC: Author.

<sup>78</sup> Office of Management and Budget. (May 19, 2004). Statement of Administration Policy: S. 2400. National Defense Authorization Act for Fiscal Year 2005. Washington DC: Author.

insurmountable, the President's State of the Union address in 2006 directing the country to reduce our reliance on foreign energy, may be enough to make ESPC use for mobile assets a reality.

#### **18. Argument Against the Use of ESPC for Mobile Assets**

Opponents of using energy savings contracts for mobile assets argue that the process side-steps congressional authority and the appropriations process. The opponents also contend that no entity can borrow cheaper than the federal government and to use corporate financing would be a waste of taxpayer's dollars because it lines the pockets of "money hungry" corporations. However, little attention is paid to the fact that, with ever constraining budgets, the likelihood of federal agencies receiving funds to upgrade mobile assets is slim to none. While maintaining the status quo retains Congressional power and oversight, millions of dollars in taxpayer savings through reduced energy consumption are lost.

#### **19. Proponents' Argument for the Use of ESPCs for Mobile Assets**

Supporters of using energy savings contracts with mobile assets contend that the energy savings from upgrades would be real and that it costs more to do nothing given the inefficiencies of many platforms being used today. Proponents also contend that the current Congressional Budget Office method for scoring ESPCs does not accurately represent the savings that would be realized through ESPCs and the scoring by CBO needs to be revised.

The cost savings are only part of the proponent's argument. Proponents also argue that ESPCs will modernize old, obsolete components of currently used platforms. The process to re-engine a B-52H would not only make the aircraft more energy efficient, but would provide for a better platform and create jobs in the process. A January 2001 Defense Science Board study examined modernizing 16 DoD weapon systems platforms to achieve energy savings.<sup>79</sup> The DSB study concluded that modernization of legacy

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<sup>79</sup> Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms. (January 2001). More Capable Warfighting Through Reduced Fuel Burden. Retrieved March 2, 2006, from <http://www.acq.osd.mil/dsb/reports/fuel.pdf>

systems would provide increased operational performance, reduce the logistics tail, decrease green house gas emissions, and offer a significant return on investment to the DoD.<sup>80</sup>

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<sup>80</sup> Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms. (January 2001). More Capable Warfighting Through Reduced Fuel Burden. Retrieved March 2, 2006, from <http://www.acq.osd.mil/dsb/reports/fuel.pdf>

## **IV. RECOMMENDATIONS**

### **A. CONCLUSION**

The federal government's historical use of public-private partnerships and related issues has been studied from different viewpoints. We have demonstrated that PPPs are very effective in providing applications of innovative financing arrangements by Hannon Armstrong, LLC. Hannon Armstrong's "fee for service contract" solution to a lack of appropriated funds for a needed fiber-optic link near the Arctic Circle saved the government \$140 million. We believe that applying Energy Savings Performance Contracts to mobile assets could further reduce the energy consumption of the Department of Defense and save taxpayers millions of dollars. Few argue about the impact that ESPCs have had in generating energy savings in fixed assets. Ideally, the federal government would use appropriated dollars to fund energy saving upgrades to all assets. However, the appropriations process is slow, time consuming, and federal funds are often not available or are prioritized to other projects. Innovative methods, such as that demonstrated by Hannon Armstrong's financing of the fiber-optic cable project, should be applied to mobile assets, such as the re-engining program for the B-52H fleet, so that these non-starter projects will become a reality and the cost savings can be realized.

### **B. FUTURE RESEARCH TOPICS**

Public Private Partnerships is a vast area of study. Future research topics could include: 1) a detailed examination of the legislative and policy changes that would be necessary to implement ESPCs for mobile assets, 2) analyzing the lessons learned from major PPPs throughout history, 3) determining the benefits of PPPs and cost savings realized over the long-term, 4) examining how functions within the federal government once deemed "inherently governmental" are slowly being privatized and determining the impact of such changes.

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